



SMART PUBLIC TRANSPORT TRACKING SYSTEM

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ABSTRACT

For peoples who don't have private vehicle, public transport system is only way to travel. In developing countries system is not as efficient as it is in developed country. To overcome the problems in the system faced by passengers, we designed a smart public transport tracking system. system is sub divided in 3 parts for 3 different situations. 3 different situations are 'at bus station', 'in vehicle' and 'in managing staff office'. These 3 subsystems are interconnected by wireless personal area network. At bus station passengers get information of upcoming vehicles to the station. In vehicle passengers get information about next upcoming stations and the route of vehicle. In managing staff office, status of all vehicle at particular time is recorded and stored in database.

I. INTRODUCTION

People widely use public transport system to travel in city. When the passenger is waiting for vehicle at bus station he doesn't know that when the vehicle will be arrived. Suppose vehicle for which passenger is waiting for get failed or trap in traffic jam, then in such situation he waits for vehicle hour and hour. This is inconvenient to passenger and it leads to improper service of public transport system. The passengers waiting for bus don't know the timings and schedule of the vehicles. To save limited energy resources, public transport is best solution to minimize fossil fuels usage. There is increased population in developing cities like Pune or metro cities like Mumbai, Chennai, and Delhi. So, there is a need to provide best services of public transport system. Since everyone's working schedule is different, they face problems of bus timings. As it is a machine, there may be failure of vehicle which may lead to improper service. We are trying to develop the system which should take care of all of above problems occur in public transport system.

Our project will help to make the passengers who travel in public transport system aware of upcoming vehicles coming to bus station if they are waiting for vehicle or next bus station and route of the vehicle if they are in the vehicle.

II. RELATED WORK

In the studies related to this topic [1], Sungur et al. designed a system for tracking the bus and show status of the bus on bus stations. This system is implemented using GPS module and web services. Also the database is maintained to record the information of routes and status of vehicles which are used for public transport system. Application was developed to manage such information. The administrator of the system easily monitored public transport traffic. Hardware used in this system are Friendly ARM Micro2440 embedded device, GPS module containing a SiRFstar3 GPS chip, server for database. Software used in system are Windows CE 6.0 OS for Friendly ARM Micro2440, Microsoft Visual Studio 2008, Oracle database management system. System worked on two cycles viz. vehicle information cycle and station information cycle as shown in fig I.1(a) and (b) respectively. Information shown on bus station screen in table format. First row of table is name of current bus station. Next row shows name of bus coming to station and its arrival time, after that next 3 row contains nearest bus to that station and their arrival time. The systems need internet connection as it uses web services.

[2], Pankaj Verma et al. designed and developed the system on GPS-GSM based tracking with google map based monitoring. System has GPS module which receives coordinates from the satellites and sends it to the web based application which shows the current position of target which is vehicles used in public transport system in our case. The system locates the goal anytime and anywhere and any weather condition if one have the GSM mobile. Hardware used in the system are AT mega microcontroller, GPS module, GSM module 16*2 LCD module and power supply. Software used in the system are wamp server, web application and software to decode NMEA protocol. The system contains two units one is transmitting unit and another is monitoring unit. Transmitting unit is set in the target vehicle and consist of GPS module, GSM module, and LCD module connected to AT mega microcontroller. GPS and GSM module connected through RS232 Protocol. GSM module requires sim card for two-way communication just like telephone. Monitoring unit consist of GSM mobile and Web application. The units are shown in fig I.2(a) and (b) respectively. The system only monitors the target not manage or store data anywhere. The system requires GSM mobile and internet to check for current location.

[3], Ajay Shingare et al. designed GPS supported bus tracking and smart Ticketing system. Android app is designed for system which track vehicle. System also

use GPS and GSM to exchange the information. Problem With the system is it needs android phone to get the status of vehicle. Again it needs internet.

III. PROPOSED SOLUTION

Our work is greatly based on embedded system and wireless networking. In this section, we explain the general background of this technology. To divide system in three parts

A. In vehicle system

B. At bus station system

C. Control room system

All above systems are connected to each other with wireless network. Vehicle system transmit its status to nearest system which can be bus station or control room. Bus station system receive vehicle system information and show it to passenger as well as transmit available information to next nearest bus station and control room if its near to it. Control room receive information of vehicles running in city by nearest bus station or vehicle itself if it is near to vehicle. As well task of control room is to manage all these data and take decision.

Description of all system is giving in detail below.

A. In Vehicle System

Public transport vehicle is main part of the system. It is too easy get the current location of the vehicle with the help of GPS. As GPS gives latitude and longitude we have to develop system that takes co-ordinates from GPS and show on the map. Again, system not dependent on internet so GPS co-ordinate need to be send to bus station on the respective vehicle route. Also, vehicles are always mobile so here wired connection is trivial. We designed wireless personal area network in order to overcome above constraints. To show all current status of the vehicle in vehicle, embedded system is required. Embedded system can be Arduino or any raspberry pi (we are using arduino embedded system). In vehicle, we are going to show vehicle current location on map, the route of vehicle, next bus stop. So, in vehicle things required are, display to show information, transmitter to send the GPS co-ordinate, GPS module to receive co-ordinate, SD card module save data.

B. At Bus Station

People wait at bus station for vehicle on route they want to go. System need to design for bus station. People should get notification of upcoming vehicles on bus station. The display is placed at the bus station. The information shown on bus station display is vehicle no., respective departure location and destination, current location, next bus stop information. Bus station is equipped with embedded system having transmitters and receivers for sending and receiving available information, SD card to store data, display to show data. Application is needed to design to display vehicle information on bus station. Also, if server is nearer to bus station it should transmit all available data to server.

C. Control Room System

To manage all the vehicles and bus station devices, control room is needed to be designed. Control room is managed by some employed people. The system in control room contains computer having database to store all vehicle information in structure format. Also, there should be application in computer which receive all vehicle status from transmitting vehicle and nearest bus station. The requirement for control room system is computer system having database and transmitter and receiver.

IV. SYSTEM IMPLEMENTATION ARCHIECTURE

Problem with above previous systems are they all need connected to internet. What if someone has no internet or no such device that can be connect to internet. The system developed by Pankaj Verma et al. only monitor the or tack the vehicle or target. This system needs GSM mobile or Web based application for communication. We are trying to develop the system which is available to any kind of passenger. The system can be developed which minimize the above limitation. So proposed system has 3 units. First for administrator, second for passenger present in vehicle of public transport system, and third for passenger waiting for vehicle of public transport system at bus stations. Architecture of proposed system is shown in fig III.1.

A. Control Unit

Administrator of the system control and manage the system based on the information provided by the public transport system's vehicle and bus station. System formed the Ad-Hoc network by connecting every bus station and control room. Route number is assigned to every vehicle of public transport system which can be change only by administrator. Control unit maintain database to store the information of all routes and corresponding vehicle number to routes. Also database also contain information of vehicle location at particular time. On the basis of database information administrator can manage the traffic and control the system.

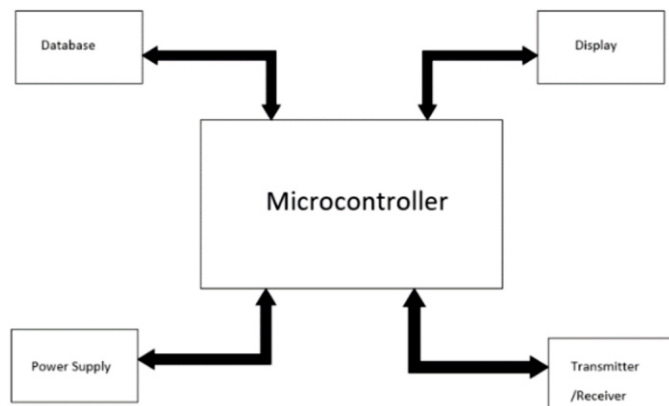


Fig IV.1 Control system architecture

B. Vehicle Unit

Vehicle of public transport system is equipped with embedded system. GPS module, display screen and long-range transmitter and receiver embedded on AT mega328 microcontroller. AT mega328 microcontroller gets location of vehicle from GPS module and transmit it to nearest bus station. As every bus station and control unit is interconnected by Ad-Hoc network, the information is pass on to next bus station and control unit. Vehicle transmit passenger count to the next bus station so that passenger on next bus stations predict for place to seat in vehicle. Display screen in vehicle shows next bus station information, current position of vehicle and route of the vehicle.

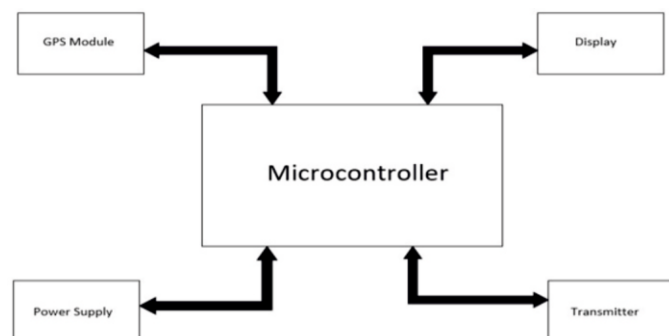


Fig IV.2 Vehicle system architecture

C. Bus Station Unit

Bus station also equipped with embedded system. Display screen, long range transmitter and receiver are embedded on AT mega328 microcontroller. Bus station unit collects information from next bus station and vehicles and display useful information on bus station display screen. Remaining information is pass on to nearest bus station. Bus station also get information about vehicle breakdown from vehicle which is pass to control unit and after then control unit can send extra vehicle for proper service.

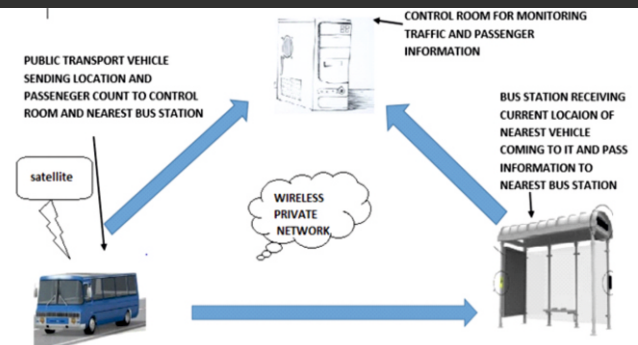


Fig. Full System Architecture

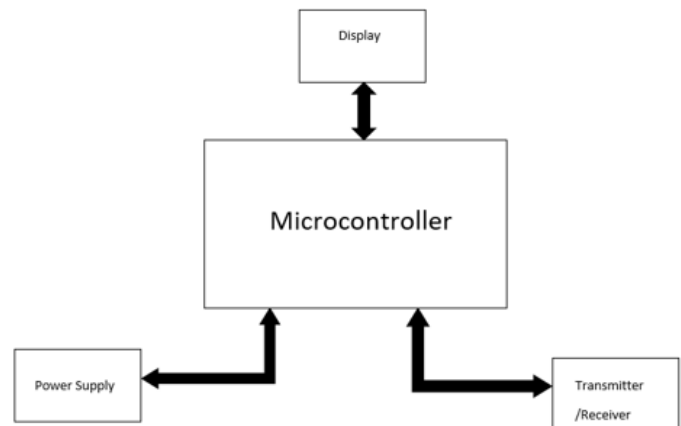


Fig IV.1 Bus station system architecture

V. HARDWARE AND SOFTWARE USED

For designing system, interconnection between above mentioned subsystem is required.

1. Microcontroller:

Microcontroller are need in all 3 subsystems for operating, controlling and managing the other components according to system need. For implementation required hardware according to architecture are given below. For demo model, we have used cheap microcontroller name Atmega 328p on Arduino uno R3 board..

2. GPS Module:

GPS module is need to get current co-ordinates from satellite. It is connected to microcontroller of the vehicle subsystem. We have used below GPS Receiver and Antenna for demo model.

3. Wireless Transmitter:

Wireless transmitter is required in all system to transmit the data they have to next nearest subsystem. As system is not depend on internet these components need for inter communication of subsystems.

4. Wireless Receiver:

Wireless receiver is required to receive the data transmitted by another subsystem, so that microcontroller can operate this data and display to passengers.

5. Power Battery:

As the system is wireless it requires battery for power. Although it can run on vehicle inter-power supply but there should extra power supply incase.

6. Display

Display is required to show the current position of vehicle on the map and other data. For displaying map, we have used computer for demo model. Microcontroller send data serially to computer and computer shows the map of current position of vehicle.

SOFTWARES

For configuring microcontroller and uploading programs in it, requires software. Used Arduino microcontroller has software name Arduino software IDE. Another program is created for accepting serial data from microcontroller and display current position on map.

VI. IMPLEMENTATION OF DEMO MODEL

Working of demo model is shown in below pictures and screen-shots.

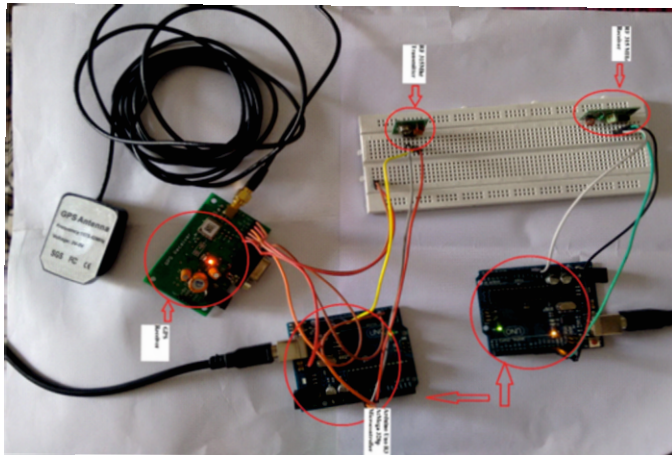


Fig. VI.1 Transmitting data from vehicle subsystem to station system

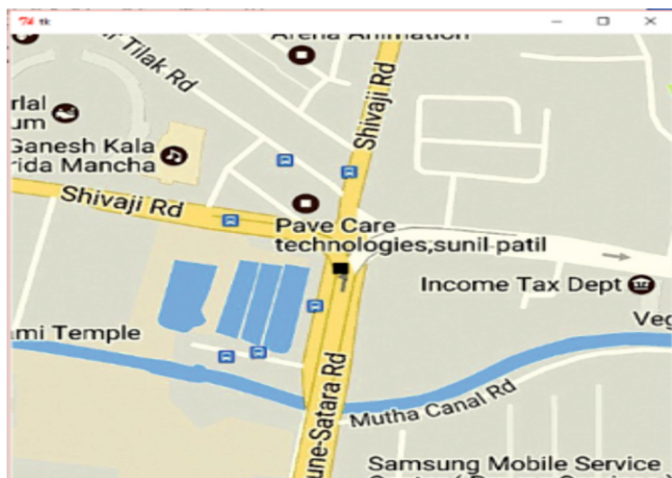


Fig. VI.2 showing current position of vehicle.

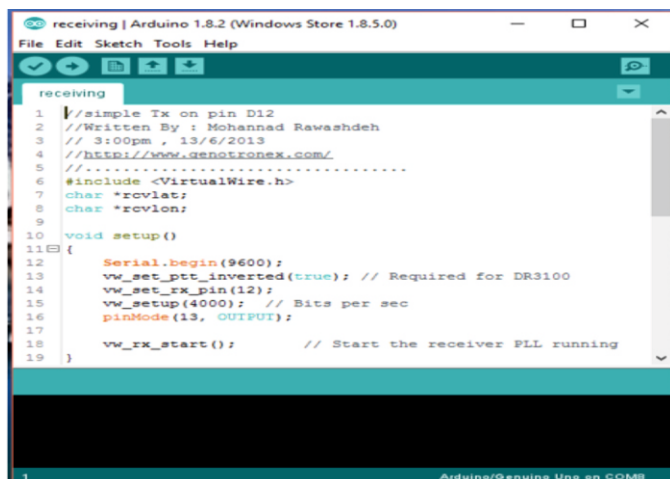


Fig. VI.3 Arduino IDE

VII. FUTURE SCOPE AND LIMITATION

Though system is implemented on small scale it can be developed more and increase life quality of passengers. Long range transmitter and receiver need for large scale implementation. Microcontroller with good computation ability require for large scale. As this system will deploy on open environment, various factors need to consider for maintenance like weather condition, battery failure, hardware failure.

To manage this system is much hard than it seems. There are many bus travelling on different routes. Scheduling of these buses according to passenger count is hard to manage.

VIII. CONCLUSION

We have implemented demo model according to proposed solution. But still development need to be done for large scale implementation. Advantages of systems are anyone can see the current position of particular vehicle without having internet and any device. System is implemented for public service. Based on implemented system, management staff can manage the system. System is beneficiary for passengers in vehicle and passenger waiting at bus station.

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